UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

to accompany

Engineering-geologic maps of northern Alaska, Umiat quadrangle

by

L. David Carter[1] and John P. Galloway[2]

Open-File Report 86-335

This report is preliminary and has not been edited or reviewed for conformity with USGS editorial standards and stratigraphic nomenclature.

[1] U.S. Geological Survey, Anchorage, Alaska

[2] U.S. Geological Survey, Menlo Park, California

SOURCES OF INFORMATION

The following list of references includes those cited in the text and in addition contains references concerning topics such as climate, permafrost, pingos, ground ice, soil development, vegetation, floods and storm surges, economic geology, and water resources, all of which are pertinent to land management considerations.

Albert, N.R.D., 1978, Landsat mosaics of eastern North Slope petroleum province, Alaska, with preliminary interpretation of observed features: U.S. Geological Survey Miscellaneous Field Studies Map MF-928V, scale 1:500,000, 3 sheets.

Alpha, T.R., and Gerin, Marybeth, 1980, Oblique map of the Beaufort Sea and the Brooks Range of Alaska: U.S. Geological Survey Open-File Report 80-455.

Anderson, D.M., Reynolds, R.C., and Brown, J., 1975, Bentonite debris flows in northern Alaska: Science, v. 164, no. 3876, p. 173-174.

Arnborg, Lennart, Walter, H.J., and Peippo, Johan, 1966, Water discharge in the Colville River, 1962: Geografiska Annaler, v. 48A, no. 4, p. 195-210.

-----, 1967, Suspended load in the Colville River, Alaska, 1962: Geografiska Annaler, v. 49A, no. 2-4, p. 133-144.

Arnold, C.A., 1959, Some paleobotanical aspects of tundra development: Ecology, v. 40, no. 1, p. 146-148.

Barnes, F.F., 1967a, Coal resources of Alaska: U.S. Geological Survey Bulletin 1242-B, p. B1-B36.

-----, 1967b, Coal resources of the Cape Lisburne-Colville River regions, Alaska: U.S. Geological Survey Bulletin 1242-E, p. E1-E37.

Batzil, G.O., and Brown, Jerry, 1976, RATE - the influence of grazing on arctic tundra ecosystems: Arctic Bulletin, Interagency Arctic Research Coordinating Committee, v. 2, p. 153-160.

Beikman, H.M., and Lathram, E.H., 1976, Preliminary geologic map of northern Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-789, scale 1:1,000,000, 2 sheets.

Benson, C.S., 1969, The seasonal snow cover of arctic Alaska: Arctic Institute of North America Research Paper 51, 85 p.

Benson, C.S., 1982, Reassessment of winter precipitation on Alaska's Arctic Slope and measurements on the flux of windblown snow: Fairbanks, University of Alaska, Geophysical Institute Report UAG R-288, 26 p.

Berg, T.E., 1984, Status of numerical models for heat and mass transfer in frost-susceptible soils, in International Conference on Permafrost, 4th, Fairbank, Alaska, 1983, Final Proceedings: Washington, D.C., National Academy Press, p. 67-92.

Bird, K.J., 1981a, Petroleum exploration of the North Slope in Alaska, U.S.A.: U.S. Geological Survey Open-File Report 81-227, 43 p.

-----, 1981b, Machine-generated displays of well logs and lithology from selected wells on the North Slope of Alaska: 11 wells from the northeastern part of the National Petroleum Reserve in Alaska (NPRA): U.S. Geological Survey Open-File Report 81-1034, 6 p., 11 sheets.

-----, 1982, Rock-unit reports of 228 wells drilled on the North Slope, Alaska: U.S. Geological Survey Open-File Report 82-278, 106 p.

-----, 1983, Oil and gas resources of the North Slope, Alaska (abs.): U.S. Geological Survey Circular 911, p. 27-30.

Black, R.F., 1951, Eolian deposits of Alaska: Arctic, v. 4, no. 2, p. 89-111.

-----, 1952, Growth of ice-wedge polygons in permafrost near Barrow, Alaska (abs): Geological Society of America Bulletin, v. 63, no. 12, p. 1235-1236.

-----, 1954a, Precipitation at Barrow, Alaska, greater than recorded: Eos (American Geophysical Union Transactions), v. 35, no. 2, p. 203-207.

-----, 1954b, Permafrost - a review: Geological Society of America Bulletin, v. 65, no. 9, p. 839-856.

-----, 1957, Some problems in engineering geology caused by permafrost in the Arctic Coastal Plain, northern Alaska: Arctic, v. 10, no. 4, p. 230-240.

-----, 1963, Les coins de glace et le gel permanent dans le Nord de l'Alaska (Ice wedges and permafrost in northern Alaska): Annales de Geographie, v. 72, p. 257-271.

-----, 1964, Gubik Formation of Quaternary age in northern Alaska: U.S. Geological Survey Professional Paper 302-C, p. 59-91.

-----, 1969, Thaw depression and thaw lakes, a review: Biuletyn Peryglacjalny, v. 18, p. 131-150.

-----, 1974, Ice-wedge polygons of northern Alaska, in Coates, D. R., ed., Glacial geomorphology: Annual Geomorphology Series, 5th, Binghamton, N.Y., 1974, Proceedings: Binghamton, State University of New York, p. 247-275.

-----, 1976, Periglacial features indicative of permafrost: Ice and soil wedges: Quaternary Research, v. 6, no. 1, p. 3-26.

-----, 1983a, Ice-wedge diapirs, northern Alaska, are produced mainly by horizontal compression (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 6, p. 527.

Black, R.F., 1983b, Three superposed systems of ice wedges at McLeod Point, northern Alaska, may span most of the Wisconsinan stage and Holocene, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Proceedings: Washington, D.C., National Academy Press, p. 68-73.

Black, R.F., and Barksdale, W.L., 1949, Oriented lakes of northern Alaska: Journal of Geology, v. 57, no. 2, p. 105-118.

Boyd, W.L., 1959, Limnology of selected arctic lakes in relation to water-supply problems: Ecology, v. 40, no. 1, p. 49-54.

Brewer, M.C., 1958a, The thermal regime of an arctic lake: Eos (American Geophysical Union Transactions), v. 39, p. 278-284.

-----, 1958b, Some results of geothermal investigations of permafrost in northern Alaska: Eos (American Geophysical Union Transactions), v. 39, p. 19-26.

-----, 1984, Petroleum exploration and protection of the environment on the National Petroleum Reserve in Alaska, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Final Proceedings: Washington, D.C., National Academy Press, p. 133-134.

Brigham, J.K., 1981, Amino-acid geochronology of Late Pliocene and Pleistocene marine transgressions on the Arctic Coastal Plain, northern Alaska: Geological Society of America, Abstracts with Programs, v. 12, no. 7, p. 417.

-----, 1983, Correlation of late Cenozoic marine transgressions of the Arctic Coastal Plain with those in western Alaska and Northeastern Russia (abs.): U.S. Geological Survey Circular 911, p. 47-52.

-----, 1984, Marine stratigraphy and amino acid geochronology of the Gubik Formation, western Arctic Coastal Plain, Alaska: U.S. Geological Survey Circular 934, p. 5-9.

-----, 1985, Marine stratigraphy and amino acid geochronology of the Gubik Formation, western Arctic Coastal Plain, Alaska: Boulder, University of Colorado, Ph.D. thesis, 316 p.

Brigham, J.K., Hopkins, D.M., Carter, L.D., and Miller, G.H., 1980, Application of amino-acid geochronology to deposits of the Arctic Coastal Plain, Alaska; preliminary results and implications, in Annual Arctic Workshop, 9th, Boulder, University of Colorado, Institute of Arctic and Alpine Research, 1980, p. 34-35.

Brigham, J.K., and Miller, G.H., 1982, Late Cenozoic history of high seal level stands and Pleistocene temperature estimates, northwestern Alaska: Geological Society of America, Abstracts with Programs, v. 14, no. 7, p. 451.

Brigham, J.K., and Miller, G.H., 1983, Paleotemperature estimates of the Alaskan Arctic Coastal Plain during the last 125,000 years, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Proceedings: Washington, D.C., National Academy Press, p. 80-85.

Britton, M.E., 1967, Vegetation of the Arctic tundra, in Hansen, H. P., ed., Arctic biology: Corvallis, Oregon State University, p. 67-130.

Brosgè, W.P., and Whittington, C.L., 1966, Geology of the Umiat-Maybe Creek Region, Alaska: U.S. Geological Survey Professional Paper 303-H, p. 501-638.

Brown, Jerry, 1965, Radiocarbon dating, Barrow, Alaska: Arctic, v. 18, no. 1, p. 36-48.

-----, 1966, Ice-wedge chemistry and related frozen-ground processes, Barrow, Alaska, in International Conference on Permafrost, Lafayette, Ind., 1963, Proceedings: Washington, D.C., National Academy of Sciences, National Research Council Publication 1287, p. 94-98.

-----, 1967, Tundra soils formed over ice wedges, northern Alaska: Soil Science Society of America, Proceedings, v. 31, p. 686-691.

-----, 1969a, Buried soils associated with permafrost, in Pedology and Quaternary Research, Edmonton, University of Alberta, Canada, 1969, Symposium: National Research Council of Canada, p. 115-128.

-----, 1969b, Soil properties developed on the complex tundra relief of northern Alaska: Biuletyn Peryglacjalny, no. 18, p. 153-167.

-----, 1969c, Ionic concentration gradients in permafrost, Barrow, Alaska: Hanover, N.H., U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory, CRREL Research Report 272, 24 p.

Brown, Jerry, Dingman, S.L., and Lewellen, R.I., 1968, Hydrology of a drainage basin on the Alaskan Coastal Plain: Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Research Report 240, 18 p.

Brown, Jerry, Everett, K.R., Webber, P.J., MacLean, S.F., and Murray, D.F., 1980, The coastal tundra at Barrow, in Brown, Jerry, and others, eds., An arctic ecosystem, the coastal tundra at Barrow, Alaska: Stroudsburg, Pa., Dowden, Hutchinson, and Ross, p. 1-29.

Brown, Jerry, Grant, C.L., Ugolini, F.C., and Tedrow, J.C.F., 1962, Mineral composition of some drainage waters from arctic Alaska: Journal of Geophysical Research, v. 67, no. 6, p. 2447-2454.

Brown, Jerry, and Johnson, P.L., 1965, Pedo-ecological investigations, Barrow, Alaska: Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Tecnical Report 159, 32 p.

Brown, Jerry, and Sellmann, P.V., 1966, Radiocarbon dating of coastal peat, Barrow, Alaska: Science, v. 153, no. 3733, p. 299-300.

Brown, Jerry, and Sellmann, P.V., 1973, Permafrost and coastal plain history of arctic Alaska: Arctic Institute of North America Technical Paper 25, p. 31-47.

Carlson, P.R., Roy, C.J., Hussey, K.M., Davidson, D.T., and Handy, R.L., 1959, Geology and mechanical stabilization of Cenozoic sediments near Point Barrow, in Davidson, D.T., and others, The geology and engineering characteristics of some Alaskan soils: Ames, Iowa State University, Engineering Experiment Station Bulletin 186, p. 101-128.

Carson, C.E., 1968, Radiocarbon dating of lacustrine strands in Arctic Alaska: Arctic, v. 21, no. 1, p. 12-26.

Carson, C.E., and Hussey, K.M., 1959, The method of multiple working hypotheses applied to the oriented lakes of northern Alaska: Iowa Academy of Sciences, Proceedings, v. 66, p. 334-349.

-----, 1960, Hydrodynamics in three arctic lakes: Journal of Geology, v. 68, no. 6, p. 585-600.

-----, 1962, The oriented lakes of arctic Alaska: Journal of Geology, v. 70, no. 4, p. 417-439.

-----, 1963, The oriented lakes of arctic Alaska, a reply: Journal of Geology, v. 71, no. 4, p. 532-533.

Carter, L.D., 1981a, A Pleistocene sand sea on the Alaskan Arctic Coastal Plain: Science, v. 211, no. 4480, p. 381-383.

-----, 1981b, Middle Wisconsinan through Holocene climate in the Ikpikpuk River region, Alaska: in Annual Arctic Workshop, 10th, Boulder, University of Colorado, Institute of Arctic and Alpine Research, 1981, p. 5-9.

-----, 1982, Late Wisconsin desertification in northern Alaska: Geological Society of America, Abstracts with Programs, v. 14, no. 7, p. 461.

-----, 1983a, Engineering-geologic maps of northern Alaska: Teshekpuk quadrangle: U.S. Geological Survey Open-File Report 83-634, scale 1:250,000.

-----, 1983b, Fossil sand wedges on the Alaskan arctic coastal plain and their paleoenvironmental significance, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Proceedings: Washington, D.C., National Academy Press, p. 109-114.

-----, 1983c, A Pleistocene sand desert in arctic Alaska (abs.): U.S. Geological Survey Circular 911, p. 36.

-----, 1983d, Cenozoic glacial and glaciomarine deposits of the central North Slope, Alaska, in Thorson, R.M., and Hamilton, T.D., eds., Glaciation in Alaska, extended abstracts from a workshop: Fairbanks, University of Alaska Museum Occasional Paper No. 2, p. 17-21.

Carter, L.D., and Brigham-Grette, J.K., and Hopkins, D.M., 1986, Late Cenozoic marine transgressions of the Alaskan Arctic Coastal Plain, in, Heginbottom, J. A., and Vincent, J. S., eds., Correlation of Quaternary deposits and events in the area around the Beaufort Sea: abstracts of the Joint Canadian-American Workshop: Geological Survey of Canada Open-File Report 1237, p. 21-26.

Carter, L.D., Ferrians, O.J., Jr., and Galloway, J.P., 1986, Engineering-geologic maps of northern Alaska, coastal plain and foothills of the Arctic National Wildlife Refuge: U.S. Geological Survey Open-File Report 86-334, 10 p., scale 1:250,000, 2 sheets.

Carter, L.D., Forester, R.M., and Nelson, R.E., 1984, Mid Wisconsin through early Holocene changes in seasonal climate in northern Alaska: American Quaternary Association, Eighth Biennial Meeting, Boulder, University of Colorado, Program with Abstracts, 1984, p. 20-22.

Carter, L.D., and Galloway, J.P., 1979a, Arctic Coastal Plain pingos in National Petroleum Reserve in Alaska, in Blean, K.M. and Williams, J.R., eds., The United States Geological Survey in Alaska - Accomplishments during 1978: U.S. Geological Survey Circular 804-B, B33-B35.

-----, 1979b, Southward-progressing stabilization of Holocene eolian sand on the western Arctic Coastal Plain, in Blean, K.M. and Williams, J.R., eds., The United States Geological Survey in Alaska - Accomplishments during 1978: U.S. Geological Survey Circular 804-B, B37-B39.

-----, 1981, Earth flows along Henry Creek, northern Alaska: Arctic v. 34 no. 4, p. 325-328.

-----, 1982, Terraces of the Colville River delta region, Alaska, in Coonrad, W.L., ed., The United States Geological Survey in Alaska - Accomplishments during 1980: U.S. Geological Survey Circular 884, p. 49-51.

-----, 1985, Engineering-geologic maps of northern Alaska, Harrison Bay quadrangle: U.S. Geological Survey Open-File Report 85-256, 48 p., scale 1:250,000, 2 sheets.

Carter, L.D., and Hopkins, D.M., 1982, Late Wisconsinan winter snow cover and sand-moving winds on the Arctic Coastal Plain of Alaska, in Annual Arctic Workshop, 11th, Boulder, University of Colorado, Institute of Arctic and Alpine Research, 1982, p. 8-10.

Carter, L.D., Nelson, R.E., and Galloway, J.P., 1984, Evidence for latest Wisconsin - early Holocene increased precipitation and summer warmth in arctic Alaska: Geological Society of America, Abstracts with Programs, v. 16, no. 5, p. 274.

Carter, L.D., Marincovich, Louie, Jr., Brouwers, E.M., and Forester, R.M., 1979, Paleogeography of a Pleistocene coastline, Alaskan Arctic Coastal Plain, in Blean, K. M. and Williams, J. R., eds., The United State Geological Survey in Alaska - Accomplishments during 1978: U.S. Geological Survey Circular 804-B, p. B39-B41.

Carter, L.D., Repenning, C.A., Marincovich, L.N., Hazel, J.E., Hopkins, D.M., McDougall, Kristin, and Naeser, C.W., 1977, Gubik and pre-Gubik Cenozoic deposits along the Colville River near Ocean Point, North Slope, Alaska, in Blean, K.M., ed., The United State Geological Survey in Alaska - Accomplishments during 1976: U.S. Geological Survey Circular 751-B, p. B12-B14.

Carter, L.D., and Robinson, S.W., 1978, Eolian sand and interbedded organic horizons at Keolok Creek on the Arctic Coastal Plain of Alaska: possible regional implications: U.S. Geological Survey Open-File Report 78-320, 26 p.

----- 1981, Minimum age of beach deposits north of Teshekpuk Lake, Arctic Coastal Plain, in Albert, N.R.D., and Hudson, Travis, eds., The United State Geological Survey in Alaska - Accomplishments during 1979: U.S. Geological Survey Circular 823-B, p. B8-B9.

Carter, R.D., Mull, C.G., Bird, K.J., and Powers, R.B., 1977, The petroleum geology and hydrocarbon potential of Naval Petroleum Reserve No. 4, North Slope, Alaska: U.S. Geological Survey Open-File Report 77-475, 61 p.

Childers, J.M., Kernodle, D.R., and Loeffler, R.M., 1979, Hydrologic reconnaissance of western arctic Alaska, 1976 and 1977: U.S. Geological Survey Open-File Report 79-699, 70 p.

Cory, F.E., Berg, R.L., Burns, C.D., and Kachadoorian, Reuben, 1979, Design considerations for airfields in NPRA, in American Society of Civil Engineers, Conference on applied techniques for cold environments, Anchorage, Alaska, 1978, Proceedings, p. 441-458.

Coulter, H.W., Hussey, K.M., and O'Sullivan, J.B., 1960, Radiocarbon dates relating to the Gubik Formation, northern Alaska: U.S. Geological Survey Professional Paper 400-B, p. B350-B351.

Craig, J.D., and Thrasher, G.P., 1982, Environmental geology of Harrison Bay, northern Alaska: U.S. Geological Survey Open-File Report 82-35, 25 p., 6 pls.

Dauson, A., 1977, The nature and distribution of lake types in the Colville River delta, Alaska: Edinburgh, University of Edinburgh, Great Britain, Department of Geography Research Discussion Paper 11.

Detterman, R.L., 1978, The arctic lowland region, potential landform and lifeform natural landmarks: U.S. Geological Survey Open-File Report 78-329, 411 p., 26 figs.

Detterman, R.L., Bickel, R.S., and Gryc, George, 1963, Geology of the Chandler region Alaska: U.S. Geological Survey Professional Paper 303-E, p. 223-324.

Detterman, R.L., Reiser, H.N., Brosgé, W.P., and Dutro, T.J., Jr., 1975, Post-Carboniferous stratigraphy, northeast Alaska: U.S. Geological Survey Professional Paper 886, 46 p.

Douglas, L.A., and Tedrow, J.C.F., 1959, Organic matter decomposition rates in arctic soils: Soil Science, v. 88, no. 6, p. 305-312.

-----, 1960, Tundra soils of arctic Alaska: International Congress of Soil Science, 7th, Repr. Trans., v. IV, p. 291-304.

Drage, B., Gilman, J.F., Hoch, D., and Griffiths, L., 1983, Hydrology of north slope coastal plain streams, in International Conference on Permafrost, 4th, Fairbanks, Alaska, Proceedings: Washington, D.C., National Academy Press, p. 249-254.

Drew, J.V., 1957, A pedologic study of Arctic Coastal Plain soils near Point Barrow, Alaska: New Brunswick, Rutgers University, N.J., Ph.D. thesis, 117 p.

Drew, J.V., and Tedrow, J.C.F., 1962, Arctic soil classification and patterned ground: Arctic, v. 15, no. 2, p. 109-116.

Drew, J.V., Tedrow, J.C.F., Shanks, R.E., and Koranda, J.J., 1958, Rate and depth of thaw in arctic soils: Eos (American Geophysical Union Transactions), v. 39, no. 4, p. 697-701.

Esch, D.C., 1984, Design and performance of road and railway embankments on permafrost, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Final Proceedings: Washington, D.C., National Academy Press, p. 25-30.

Everett, K.R., 1979, Evolution of the soil landscape of the Arctic Coastal Plain as exemplified at Atkasook, Alaska: Arctic, v. 32, p. 207-223.

Ferrians, O.J., Jr., compiler, 1965, Permafrost map of Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-445, scale 1:2,500,000.

Fredericksen, N.O., Ager, T.A., Oftedahl, O.G., and Edwards, L.E., 1985, Palynological samples near the Cretaceous-Tertiary boundary, North Slope of Alaska (abs.), in Society of Economic Paleontologists and Mineralogist Mid-year Annual Meeting, Golden, Colo., 1986, v. 2, p. 31.

Furbringer, W., and Walker, H.J., 1973, Structure and mineralogy of a sediment core from the Colville River delta, Alaska: Polarforschung, v. 43, no. 1/2, p. 5-54.

Galloway, J.P., 1982, Grain-size analyses of 20 eolian sand samples from northern Alaska, in Coonrad, W., ed., The United State Geological Survey in Alaska - Accomplishments during 1980: U.S. Geological Survey Circular 884, p. 51-53.

Galloway, J.P., and Carter, L.D., 1978, Preliminary map of pingos in National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 78-795, scale 1:500,000.

Glude, W.J., and Sloan, C.E., 1980, Reconnaissance snow survey of the National Petroleum Reserve in Alaska, April-May, 1979: U.S. Geological Survey Water-Resources Investigations 80-49, NTIS no. PB-80 225 006, 13 p.

Gold, L.W., and Lachenbruch, A.H., 1973, Thermal conditions in permafrost a review of North American literature, in International Conferfence on Permafrost, North American Contribution, 2nd, Yakutsk, U.S.S.R.: Washington, D.C., National Academy of Sciences, p. 3-25.

Gryc, George, Patton, W.W., Jr., and Payne, T.G., 1951, Present Cretaceous stratigraphic nomenclature of northern Alaska: Washington Academy of Sciences Journal, v. 41, p. 159-167.

Gryc, George, Tailleur, I.L., and Brosgé, W.P., 1969, Geologic framework of the "North Slope" petroleum province: U.S. Geological Survey Open-File Report 69-115, 15 p.

Hamilton, T.D., 1967, Alaskan temperature fluctuations and trends: an analysis of recorded data: Arctic, v. 18, no. 2, p. 105-117.

-----, 1979, Surficial geology, Chandler Lake quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF 1121, scale 1:250,000.

-----, 1981, Multiple moisture sources in the Brooks Range glacial record, in Annual Arctic Workshop, 10th, Boulder, University of Colorado, Institute of Arctic and Alpine Research, 1981, p. 16-18.

Hamilton, T.D., and Bauer, D.P., 1984, Engineering-geologic maps of northern Alaska: Howard Pass quadrangle: U.S. Geological Survey Open-File Report 84-401, scale 1:250,000.

Hanna, G.D., 1963, Oil seepages on the Arctic Coastal Plain, Alaska: San Francisco, California Academy of Sciences, Occasional Papers, no. 38, 18 p., 1 fig., 1 pl.

Haugen, R.K., and Brown, Jerry, 1980, Coastal-inland distribution of summer air temperature and precipitation in northern Alaska, in Batzli, G.O., ed., Patterns of vegetation and herbivory in arctic tundra, results from the research on Arctic tundra environments (RATE) program: Arctic and Alpine Research, v. 12, no. 4, p. 403-412.

Hittelman, A.M., 1982, Catalog of geological and geophysical data for the National Petroleum Reserve in Alaska: Boulder, Colo., N.O.A.A., National Geophysical and Solar-Terrestrial Data Center.

Hussey, K.M., and Michelson, R.W., 1966, Tundra relief features near Point Barrow, Alaska: Arctic, v. 19, p. 162-184.

Johnson, K.M., 1978, Map showing slopes and selected geomorphic features, National Petroleum Reserve - Alaska: U.S. Geological Survey Open-File Report 78-206, scale 1:500,000.

Kachadoorian, Reuben, Crory, F.E., and Berg, R.L., 1979, Design of airfields in National Petroleum Reserve in Alaska, in Blean, K.M. and Williams, J.R., eds., The United State Geological Survey in Alaska - Accomplishments during 1978: U.S. Geological Survey Circular 804-B, p. B51-B52.

Kaiser Engineers, Inc., 1977, Technical and economic feasibility of surface mining coal deposits, North Slope of Alaska, Final report: U.S. Bureau of Mines Open-File Report 153-77, 158 p.

Kirschner, C.E., 1983, The Arctic Platform in the National Petroleum Reserve in Alaska - deposition, deformation, and petroleum potential (abs.): U.S. Geological Survey Circluar 911, p. 24-27.

Komarkova, V., 1983, Recovery of plant communities and summer thaw at the 1949 Fish Creek Test Well I, arctic Alaska, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Proceedings: Washington, D.C., National Academy Press, p. 645-650.

Lachenbruch, A.H., 1957, Three dimensional heat conduction beneath heated buildings: U.S. Geological Survey Bulletin 1052-B, 69 p.

-----, 1959, Periodic heat flow in a stratified medium with application to permafrost problems: U.S. Geological Survey Bulletin 1083-A, 34 p.

-----, 1962, Mechanics of thermal contraction cracks and ice-wedge polygons in permafrost: Geological Society of America Special Paper 70, 69 p.

Lachenbruch, A.H., Brewer, M.C., Greene, G.W., and Marshall, B.V., 1962, Temperatures in permafrost, in Temperature -its measurement and control in science and industry, v. 3, pt. 1: New York, N.Y., Reinhold, p. 791-803.

Lachenbruch, A.H., and Marshall, B.V., 1969, Heat flow in the Arctic: Arctic, v. 22, no. 3, p. 300-311.

Lachenbruch, A.H., Sass, J.H., Lawver, L.A., Brewer, M.C., and Moses, T.H., Jr., 1982, Depth and temperature on the Alaskan Arctic Slope; preliminary results: U.S. Geological Survey Open-File Report 82-1039, 30 p.

Lathram, E.H., 1965, Preliminary geologic map of northern Alaska: U.S. Geological Survey Open-File Report 254, scale 1:1,000,000, 2 sheets.

Lawson, D.E., 1982, Long-term modifications of perennially frozen sediment and terrain at East Oumalik, northern Alaska: Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Report 82-36, 33 p.

-----, 1983 Ground ice in perennially frozen sediments, northern Alaska: in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Proceedings: Washington, D.C., National Academy Press, p. 695-700.

Lawson, D.E., Brown, J., Everett, K.R., Johnson, A.W., Komarkova, V., Murray, B.M., Murray, D.F., and Webber, P.J., 1978, Tundra disturbance and recovery following the 1949 exploratory drilling, Fish Creek, northern Alaska: Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Report 78-28, 91 p.

Livingstone, D.A., 1954, On the orientation of lake basins: American Journal of Science, v. 252, p. 547-554.

Livingstone, D.A., Bryan, Kirk, Jr., and Leahy, R.G., 1958, Effects of an arctic environment on the origin and development of freshwater lakes: Limnology and Oceanography, v. 3, p. 194-214.

McKenzie, L.S., and Walker, H.J., 1974, Morphology of an arctic river bar: Baton Rouge, Louisiana State University, Coastal Studies Institute Techinical Report.

McVee, C.V., and Tileston, J.V., 1984, Regulatory responsibilities in permafrost environments of Alaska from the perspective of a federal land manager, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Final Proceedings: Washington, D.C., National Academy Press, p. 125-128.

Marincovich, Louie, Jr., Brouwers, Elisabeth, and Carter, L. D., 1985, Early Tertiary marine fossils from northern Alaska: implications for Arctic Ocean paleogeography and faunal evolution: Geology, v. 13, p. 770-773.

Martin, G.C., and Callahan, J.E., 1978, Preliminary report on the coal resources of the National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 78-1033, 23 p., scale 1:500,000, 2 plates.

Mather, J.R., and Thornthwaite, C.W., 1958, Microclimate investigations at Point Barrow, Alaska, 1957-58: Centerton, N.J., Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, v. 9, no. 2.

Metz, M.C., 1984, Pipeline workpads in Alaska, in International Conference on Permafrost, 4th, Fairbanks, Alaska, Final Proceedings: Washington, D.C., National Academy Press, p. 106-108.

Miller, R.D., 1984, Thermally induced regelation: a qualitative discussion, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Final Proceedings: Washington, D.C., National Academy Press, p. 61-63.

Molenaar, C.M., 1981, Depositional history and seismic stratigrahy of Lower Cretaceous rocks, National Petroleum Reserve in Alaska and adjacent areas: U.S. Geological Survey Open-File Report 81-1084, 42 p.

Morrissey, L.A., 1979, Succession of plant communities in response to thaw-lake activity on the Arctic coastal Plain, Alaska: San Jose, San Jose State University, Calif., M.Sc. thesis, 71 p.

Morrissey, L.A., and Ennis, R.A., 1981, Vegetation mapping of the National Petroleum Reserve in Alaska using LANDSAT digital data: U.S. Geological Survey Open-File Report 81-315, 25 p.

Mowatt, T.C., Naidu, A.S., and Veach, Nomok, 1974, Clay mineralogy of the lower Colville River and Colville delta, north arctic Alaska: Fairbanks, Alaska Division of Geological and Geophysical Surveys Open File Report AOF-45, 39 p.

Nelson, R. E., and Carter, L. D., 1985, Pollen analysis of a part of the Gubik Formation, Arctic Coastal Plain, Alaska: Quaternary Research, v. 24, no. 3, p. 295-306.

Olhoeft, G.R., 1978, Electrical properties of permafrost, in International Conference on Permafrost, 3rd. Proceedings: Ottawa, National Research Council of Canada, p. 127-131.

Olhoeft, G.R., Watts, Ray, Frischknecht, Franck, Bradley, F., and Dansereau, D., 1978, Electromagnetic geophysical exploration in the National Petroleum Reserve in Alaska: Symposium on Permafrost Field Methods, Saskatoon, Saskatchewan, 1977, Proceedings: Ottawa, National Research Council of Canada, Technical Memorandum.

Osterkamp, T.E., 1972, Properties of ice in the Colville River area, in Kinney, P.J., and others, Baseline data study of the Alaskan arctic aquatic environment: Fairbanks, University of Alaska, Institute of Marine Sciences Report R72-3, p. 49-58.

-----, 1984, Response of Alaskan permafrost to climate, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Final Proceedings: Washington, D.C., National Academy Press, p. 145-152.

Osterkamp, T.E., and Payne, M.W., 1981, Estimates of permafrost thickness from well logs in northern Alaska: Cold Regions Science and Technology, v. 5, p. 13-27.

O'Sullivan, J.B., 1961, Quaternary geology of the Arctic Coastal Plain, northern Alaska: Ames, Iowa State University of Science and Technology, Ph.D. thesis, 191 p.

-----, 1966, Geochemistry of permafrost, Barrow, Alaska, in International Conference on Permafrost, Lafayette, Ind., 1963, Proceedings: National Academy of Sciences, National Research Council Publication 1287, p. 30-37.

O'Sullivan, J.B., Davidson, D.T., Roy, C.J., Handy, R.L., and Hussey, K.M., 1959, Crude oil for stabilization of soil materials at Point Barrow, in Davidson, D.T., and others, The geology and engineering characteristics of some Alaskan soils: Ames, Iowa State University, Engineering Experiment Station Bulletin 186, p. 129-149.

O'Sullivan, J.B., and Hussey, K.M., 1957, Problems associated with soil stabilization in the vicinity of Point Barrow, Alaska: Ames, Iowa Academy of Sciences Proceedings, v. 64, p. 429-442.

Payne, T.G., and others, 1951, Geology of the arctic slope of Alaska: U.S. Geological Survey Oil and Gas Investigations Map OM-126, scale 1:1,000,000, 3 sheets.

Price, W.A., 1963, The oriented lakes of arctic Alaska; a discussion: Journal of Geology, v. 71, no. 4, p. 530-532.

Reed, J.C., 1958, Exploration of Naval Petroleum Reserve No. 4 and adjacent areas, northern Alaska, 1944-1953, part 1, History of the exploration: U.S. Geological Survey Professional Paper 301, 192 p.

Repenning, C.A., 1983, New evidence for the age of the Gubik Formation, Alaskan North Slope: Quaternary Research, v. 19, no.3, p. 356-372.

Rex, R.W., 1961, Hydrodynamic analyses of circulation and orientation of lakes in northern Alaska, in Raasch, G.O., ed., Geology of the Arctic: Toronto, Canada, University of Toronto Press, p. 1021-1043.

Rickert, D.A., and Tedrow, J.C.F., 1967, Pedologic investigations of some eolian deposits of northern Alaska: Soil Science, v. 104, p. 250-262.

Robinson, F.M., and Collins, F.R., 1959, Core test, Sentinel Hill area and test well, Fish Creek area, Alaska: U.S. Geological Survey Professional Paper 305-I, p. 485-521.

Rosenfeld, G.A., and Hussey, K.M., 1958, A consideration of the problem of oriented lakes: Ames, Iowa Academy of Sciences, Proceedings, v. 65, p. 279-287.

Schell, D., and Hall, G., 1972, Water chemistry and nutrient regeneration process studies, in Kinney, P.J., and others, Baseline data study of the Alaskan arctic aquatic environment: Fairbanks, University of Alaska, Institute of Marine Sciences Report R72-3, p. 3-28.

Schindler, J., and Walker, H.J., 1975, Nearshore environments of the North Slope and the petroleum industry: Geoscience and Man, v. 13, p. 67-76.

Schrader, F.C., 1904, A reconnaissance in northern Alaska across the Rocky Mountains, along the Koyukuk, John, Anaktuvuk, and Colville Rivers and the arctic coast to Cape Lisburne in 1901: U.S. Geological Survey Professional Paper 20, 139 p.

Sellmann, P.V., and Brown, Jerry, 1965, Coring of frozen ground, Barrow, Alaska: Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Special Report 82, 8 p.

Sellman, P.V., and Brown, Jerry, 1973, Stratigraphy and diagenesis of perennially frozen sediments in the Barrow, Alaska region, in International Conference on Permafrost, North American Contribution, 2nd, Yakutsk, U.S.S.R.: National Academy of Sciences, p. 171-181.

Sellmann, P.V., Brown, Jerry, Lewellen, R.I., McKim, H., and Merry, Carolyn, 1975, The classification and geomorphic implications of thaw lakes on the arctic coastal plain, Alaska: Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Research Report 344, 21 p.

Sellmann, P.V., Carey, K.L., Keeler, Charles, and Hartwell, A.D., 1972, Terrain and coastal conditions on the Arctic Alaskan Coastal Plain: Hanover N.H., U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Special Report 165, 74 p.

Sellmann, P.V., Weeks, W.F., and Campbell, W.J., 1975, Use of side-looking airborne radar to determine lake depth in the Alaskan North Slope: Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Special Report 230, 6 p.

Slaughter, C.W., Mellor, Malcolm, Sellmann, P.V., Brown, Jerry, and Brown, L., 1975, Accumulating snow to augment the fresh water supply at Barrow, Alaska: Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Special Report 217, 21 p.

Sloan, C.E., 1983, Hydrology of the North Slope, Alaska (abs.): U.S. Geological Survey Circular 911, p. 44.

Sloan, C.E., and Snyder, F.F., 1978, Hydrologic and reconnaissance of lakes in NPRA, in Johnson, K.E., ed., The United States Geological Survey in Alaska - Accomplishments during 1977: U.S. Geological Survey Circular 772-B, p. B28-B29.

Sloan, Charles, Trabant, Dennis, and Glude, William, 1979, Reconnaissance snow surveys of the National Petroleum Reserve in Alaska, April 1977 and April-May 1978: U.S. Geological Survey Water-Resources Investigations Open-File Report 79-1342, 31 p.

Smith, M., 1984, Climate change and other effects on permafrost, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Final Proceedings: Washington, D.C., National Academy Press, p. 153-155.

Smith, P.S., and Mertie, J.B., Jr., 1930, Geology and mineral resources of northwestern Alaska: U.S. Geological Survey Bulletin 815, 351, p.

Stefansson, Vilhjalmur, 1980, Underground ice sheets of the arctic tundra: American Geographical Society Bulletin, v. 40, p. 176-177.

-----, 1910, Ground ice in northern Alaska: American Geographical Society Bulletin, v. 42, p. 337-345.

Taber, Stephen, 1943, Perennially frozen ground in Alaska: its origin and history: Geological Society of America Bulletin, v. 54, p. 1433-1548.

Tailleur, I.L., and Engwicht, S.E., 1978, Generalized structure map of top, middle, and basal Tertiary markers with geothermal gradients, eastern North Slope petroleum province, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-928B, scale 1:500,000.

Tedrow, J.C.F., 1965, Concerning genesis of the buried organic matter in tundra soil: Soil Science Society of America, Proceedings, v. 29, p. 89-90.

-----, 1969, Thaw lakes, thaw sinks, and soils in northern Alaska: Biuletyn Peryglacjalny, no. 20, p. 337-344.

-----, 1977, Soils of the polar landscapes: New Brunswick, N.J., Rutgers University Press, 638 p.

Tedrow, J.C.F., and Cantlon, J.E., 1958, Concepts of soil formation and classification in arctic regions: Arctic, v. 11, no. 3, p. 166-179.

Tedrow, J.C.F., Drew, J.V., Hill, D.E., and Douglas, J.A., 1958, Major genetic soils of the Arctic Slope of Alaska: Journal of Soil Science, v. 9, p. 33-45.

Tedrow, J.C.F., and Hill, D.E., 1955, Arctic brown soil: Soil Science, v. 80, p. 265-275.

U.S. Geological Survey, 1979, An environmental evaluation of potential petroleum development on the National Petroleum Reserve in Alaska: prepared by the U.S. Geological Survey, under Section 105(b) of the Naval Petroleum Reserve, Production Act of 1976, 238 p.

Wahrhaftig, Clyde, 1965, Physiographic divisions of Alaska: U.S. Geological Survey Professional Paper 482, 52 p., 6 pls.

Walker, H.J., 1966, Permafrost and ice-wedge effect on river bank erosion, in International Conference on Permafrost, Lafayette, Ind., 1963, Proceedings: National Academy of Sciences, National Research Council Publication 1287, p. 164-171.

-----, 1973 Morphology of the North Slope, in Britton, M. E., ed., Alaskan arctic tundra: Washington, D.C., Arctic Institute of North America Technical Paper 25, p. 49-92.

-----, 1975, Intermittent arctic streams and their influence on landforms: Catena, v. 2, p. 181-192.

Webber, P.J., 1984, Terrain sensitivity and recovery in Arctic regions, in International Conference on Permafrost, 4th, Faribanks, Alaska, 1983, Final Proceedings: Washington, D.C., National Academy Press, p. 135-136.

Williams, J.R., 1965, Ground water in permafrost regions, with emphasis on Alaska - an annotated bibliography, including a glossary of terms: U.S. Geological Survey Water-Supply Paper 1792, 297 p.

-----, 1970, A review of water resources of the Umiat area, northern Alaska: U.S. Geological Survey Circular 636, 8 p.

_____, 1983a, Engineering-geologic maps of northern Alaska, Meade River quadrangle: U.S. Geological Survey Open-File Report 83-294, 29 p., scale 1:250,000.

Williams, J.R., 1983b, Engineering-geologic maps of northern Alaska, Wainwright Quadrangle: U.S. Geological Survey Open-File Report 83-457, 28 p., scale 1:250,000.

Williams, J. R., and Carter, L.D., 1984, Engineering-geologic maps of northern Alaska: Barrow quadrangle: U.S. Geological Survey Open-File Report 84-124, 39 p., scale 1:250,000, 2 sheets.

Williams, J.R., Carter, L.D., and Yeend, W., 1978, Coastal plain deposits of NPRA, in Johnson, K.M., ed., The United State Geological Survey in Alaska - Accomplishments during 1977: U.S. Geological Survey Circular 772-B, p. B20-B22.

Williams, J.R., Yeend, W., Carter, L.D., and Hamilton, T.D., 1977, Preliminary surficial deposits map of National Petroleum Reserve - Alaska: U.S. Geological Survey Open-File Report 77-868, scale 1:500,000, 2 sheets.

Williams, P.J., 1984, Moisture in frozen soils, in International Conference on Permafrost, 4th, Fairbanks, Alaska, 1983, Final Proceedings: Washington, D.C., National Academy Press, p. 64-66.

Witmer, R.J., Haga, Hideyo, and Mickey, M.B., 1981, Biostratigraphic report of thirty-three wells drilled from 1975 to 1981 in National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 81-1166, 47 p.

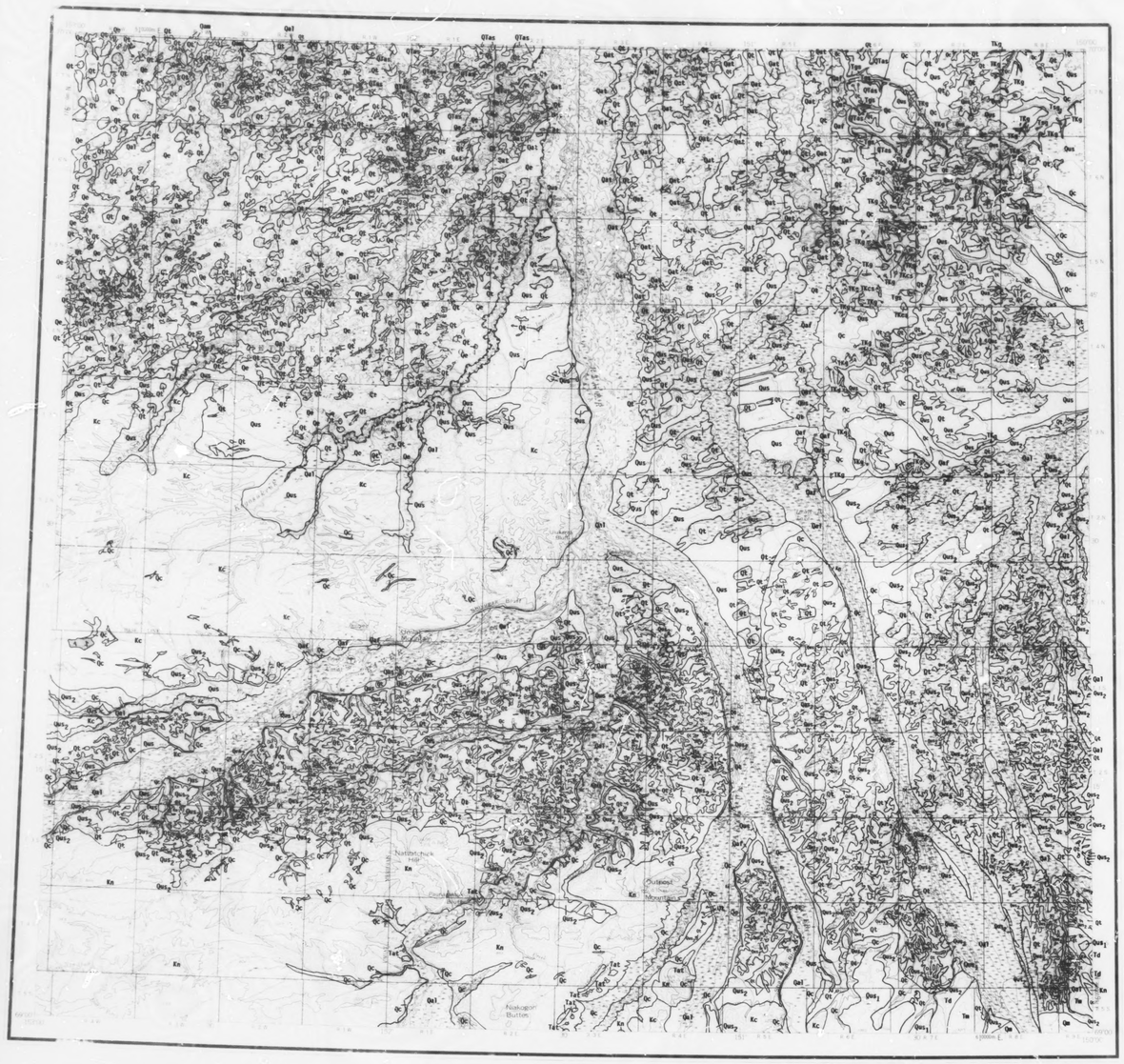
Witmer, R.J., Mickey, M.B., and Haga, Hideyo, 1981, Biostratigrahic correlations of selected test wells of National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 81-1165, 89 p., 6 pl.

Yeend, Warren, 1983, Engineering-geologic maps of northern Alaska, Lookout Ridge quadrangle: U.S. Geological Survey Open-File Report 83-279, scale 1:250,000, 2 sheets.

-----, 1984, Engineering-geologic maps of northern Alaska: Utukok River quadrangle: U.S. Geological Survey Open-File Report 84-682, scale 1:250,000, 2 sheets.

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 86-335
SHEET 1 OF 2



Base from U.S. Geological Survey 1:250,000 Umiat, 1955.
Surficial geology mapped 1977 - 1982.
Contacts between Colville group and Nanushuk group
from Detterman and others (1963) and Brosgé and
Whittington (1966).

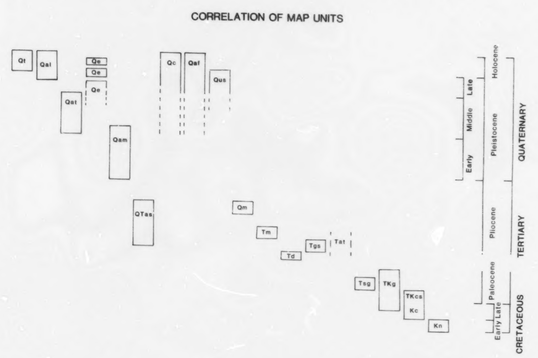
scale 1:250,000

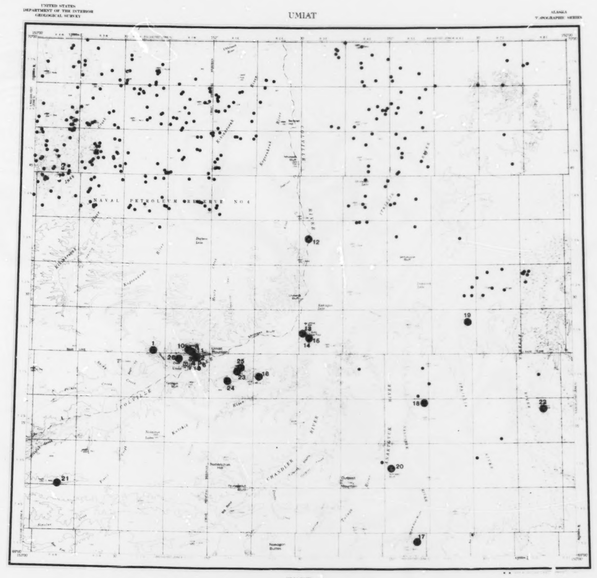
0 5 10 15 20 MILES

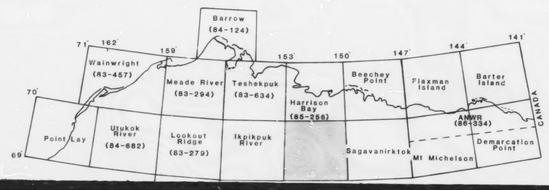
0 5 10 15 20 25 KILMETERS

contour interval 100 feet

CORRELATION OF MAP UNITS







MAP SYMBOLS

GEOLOGIC MAP

Contact

Scarp

Kc (vertical or near vertical exposures)

Linear feature visible on aerial photographs

INSERT MAP

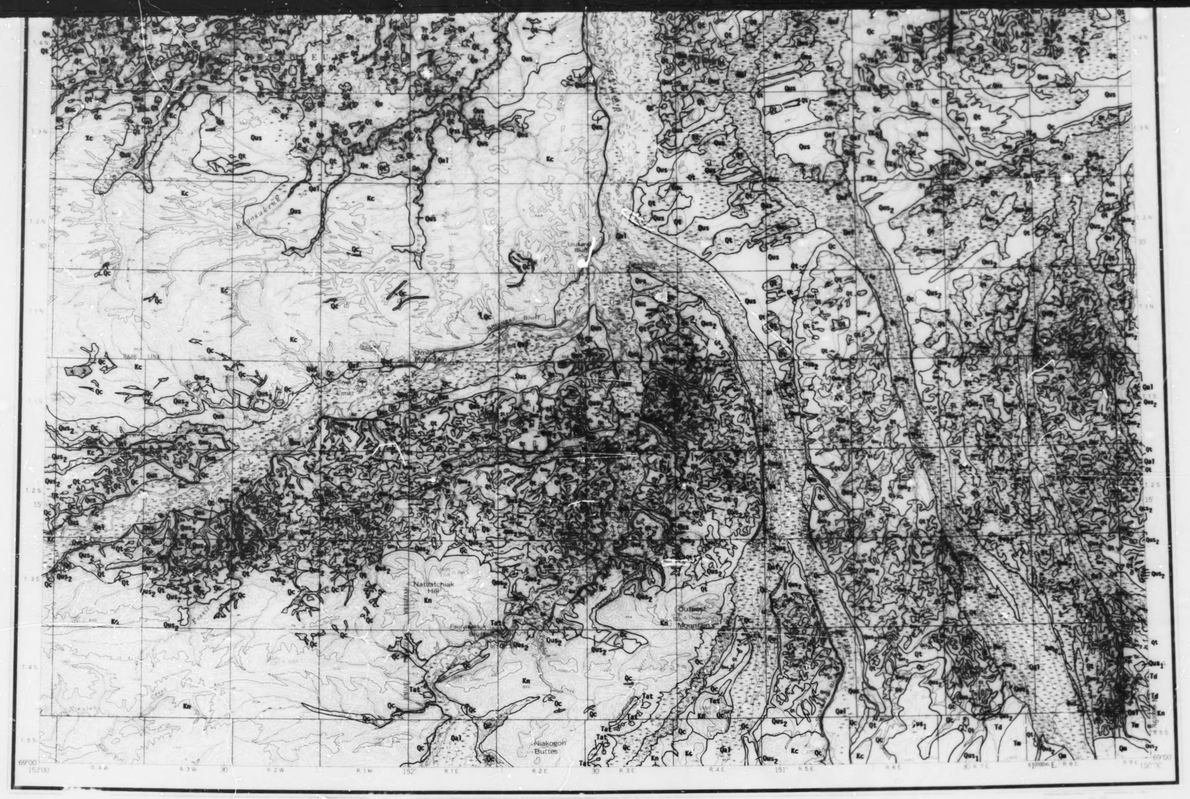
1 Test well (see insert table)

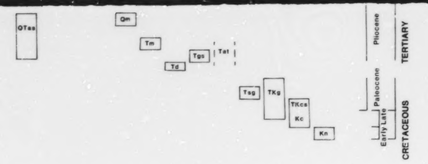
Pingo (1 to 3)

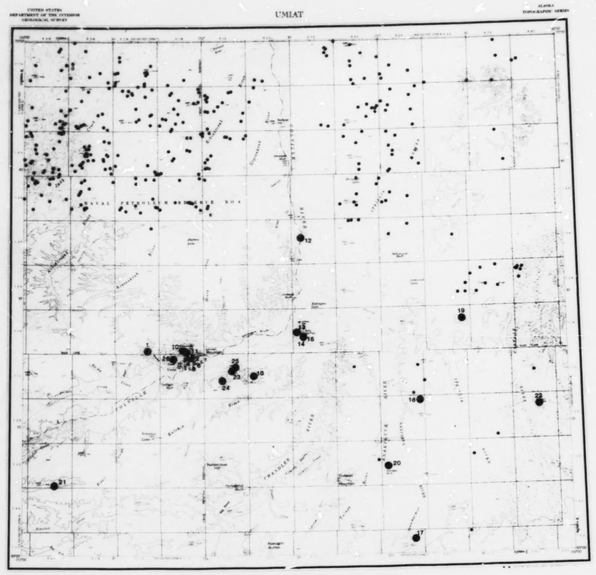
TEST WELLS

#	Well	well depth ft	well depth m	unconsolidated deposits (1) ft	unconsolidated deposits (1) m	Latitude	Longitude
1	Umiat no. 1	6005	1830	-	-	69° 23' 52" N	152° 19' 45" W
2	Umiat no. 2	6212	1893	70	21	69° 23' 03" N	152° 05' 00" W
3	Umiat (Core Test 1) no. 3	572	174	60	18	69° 23' 16" N	152° 05' 13" W
4	Umiat (Ruby 1) no. 4	840	256	90	27	69° 23' 20" N	152° 04' 53" W
5	Umiat (Ruby 2) no. 5	1077	328	65	20	69° 23' 04" N	152° 04' 55" W
6	Umiat (Ruby 3) no. 6	825	251	30	9	69° 22' 44" N	152° 05' 39" W
7	Umiat (Ruby 4) no. 7	1384	422	50	15	69° 22' 32" N	152° 06' 16" W
8	Umiat no. 8	1327	404	20	6	69° 23' 58" N	152° 06' 56" W
9	Umiat no. 9	1257	383	-	-	69° 23' 13" N	152° 10' 10" W
10	Umiat no. 10	1573	476	-	-	69° 24' 03" N	152° 07' 56" W
11	Umiat no. 11	3303	1007	20	6	69° 24' 29" N	152° 05' 57" W
12	Sentinell Hill (CR) no. 11	1180	360	-	-	69° 36' 56" N	151° 27' 11" W
13	Gubik no. 1	6000	1829	65	20	69° 26' 03" N	151° 29' 35" W
14	Gubik no. 2	4620	1408	110	33	69° 25' 28" N	151° 26' 32" W
15	Gubik Unit no. 1	4406	1343	90	27	69° 25' 22" N	151° 26' 32" W

F1







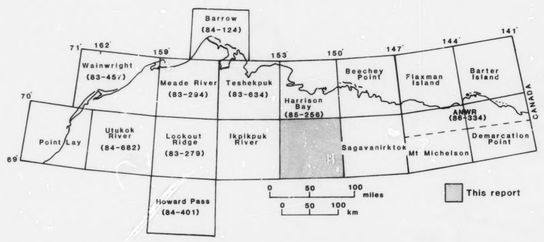
Base from U.S. Geological Survey 1:250,000 Umiat, 1955.
Surficial geology mapped 1977 - 1982.
Contacts between Gubik group and Nanushuk group from Detterman and others (1963) and Brosgé and Whittington (1966).

scale 1:250,000

0 5 10 15 20 MILES

0 5 10 15 20 25 KILOMETERS

contour interval 100 feet



Index map of northern Alaska showing published 1:250,000 scale engineering-geologic maps, which are identified by the U.S. Geological Survey Open-File Report number in parentheses under the quadrangle name.

MAP SYMBOLS

GEOLOGIC MAP

- Contact
- Scarp
- Kc (vertical or near vertical exposures)
- Linear feature visible on aerial photographs: origin uncertain (northeast corner of the map)
- Landslide

INSERT MAP

- Test well (see insert table)
- Pingo (1 to 3)

TEST WELLS

#	Well	well depth ft	well depth m	unconsolidated deposits (1) ft	unconsolidated deposits (1) m	Latitude	Longitude
1	Umiat no. 1	6005	1830	-	-	69° 23' 52" N	152° 19' 45" W
2	Umiat no. 2	6212	1893	70	21	69° 23' 03" N	152° 05' 00" W
3	Umiat (Core Test 1) no. 3	572	174	60	18	69° 23' 16" N	152° 05' 13" W
4	Umiat (Ruby 1) no. 4	840	256	90	27	69° 23' 20" N	152° 04' 53" W
5	Umiat (Ruby 2) no. 5	1077	328	65	20	69° 23' 04" N	152° 04' 55" W
6	Umiat (Ruby 3) no. 6	825	251	30	9	69° 22' 44" N	152° 05' 39" W
7	Umiat (Ruby 4) no. 7	1384	422	50	15	69° 22' 32" N	152° 06' 16" W
8	Umiat no. 8	1327	404	20	6	69° 23' 58" N	152° 06' 56" W
9	Umiat no. 9	1257	383	-	-	69° 23' 13" N	152° 10' 10" W
10	Umiat no. 10	1573	476	-	-	69° 24' 03" N	152° 07' 56" W
11	Umiat no. 11	3303	1007	20	6	69° 24' 29" N	152° 05' 57" W
12	Sentinell Hill (CR) no. 11	1180	360	-	-	69° 36' 56" N	151° 27' 11" W
13	Gubik no. 1	6000	1829	65	20	69° 26' 03" N	151° 29' 35" W
14	Gubik no. 2	4620	1408	110	33	69° 25' 28" N	151° 26' 32" W
15	Gubik Unit no. 1	4406	1343	90	27	69° 25' 22" N	151° 26' 32" W
16	East Umiat no. 1	3347	1020	75	23	69° 20' 40" N	151° 44' 36" W
17	Shale Wall Unit no. 1	4026	1227	75	23	69° 01' 56" N	150° 51' 48" W
18	Kuparuk Unit no. 1	6570	2002	60	18	69° 17' 48" N	150° 49' 49" W
19	Itkillik Unit no. 1	7751	2362	60	18	69° 27' 20" N	150° 34' 32" W
20	Schrader Unit no. 1	5129	1563	100	30	69° 10' 36" N	151° 00' 38" W
21	Little Twist Unit no. 1	3625	1105	-	-	69° 08' 26" N	152° 49' 06" W
22	East Kuparuk Unit no. 1	7000	2134	75	229	69° 17' 16" N	150° 09' 23" W
23	East Umiat Unit no. 2	2841	866	150	46	69° 21' 33" N	151° 51' 42" W
24	Colville Unit no. 1	4150	1265	75	23	69° 20' 13" N	151° 54' 43" W
25	Colville Unit no. 2	3254	991	75	23	69° 21' 55" N	151° 49' 55" W
26	Seabee no. 1	15611	4758	100	30	69° 42' 48" N	152° 10' 31" W

(1) unconsolidated deposits - thickness is usually estimated (see Bird, 1982, USGS Open-File 82-278)

F2

ENGINEERING-GEOLOGIC MAPS OF NORTHERN ALASKA, UMIAT QUADRANGLE

by

L. David Carter and John P. Galloway

1986

This report is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 86-335
SHEET 2 OF 2

DESCRIPTION OF MAP UNITS

	Description of materials	Distribution and thickness	Topography and drainage	Permafrost	Susceptibility to frost action	Suitability for construction	Special problems
Qt Thermokarst deposits	Lithology dependent upon the materials in which the thermokarst develops. Thermokarst deposits developed in units Qam, Qat, and Qfas are fine to medium sand and silty sand; those in eolian sand (Qe) consist of fine sand; and lake deposits formed in the upland silt unit (Qus) are composed of silt to very fine sand. All of the deposits contain disseminated detrital organic matter and chunks of peat of various sizes. Unit includes the deposits of minor streams that cross or connect lake basins.	Occurs in surficial deposits throughout the quadrangle but not differentiated in alluvium. Generally less than 3 m thick.	Forms flat to moderately dissected areas within isolated, interlocking, or overlapping basins. Maximum surface relief within basins ranges from about 3 m to 10 m and is determined by the degree of dissection and presence of pingos. Pingos occur primarily in lake deposits developed in eolian sand (Galloway and Carter, 1978; Carter and Galloway, 1979) and attain a maximum height of about 10 m. Maximum relief between basin floors and surrounding areas ranges from about 5 m to 15 m. Drainage is poor except in those basins in the eolian sand unit that have been breached and deeply dissected.	Perennially frozen immediately below a thin active layer about 0.5 m thick. Amount of excess ice is largely dependent upon the age of the deposits; early Holocene deposits are ice-rich, whereas the deposits and subjacent strata of recently drained basins may have relatively low ice contents. However, wedge ice in the subjacent strata may have survived the lake episode if the lake was shallower than 2 m.	Highly frost susceptible where developed in marine silt and clay. Susceptibility in remainder of area varies within individual lake deposits depending upon silt content and amount of detrital organic matter; deposits in the central part of lake basins generally very susceptible due to concentration of silt and organic matter.	Generally unsuitable as a source of materials due to silt, organic and ice content and the seasonal flooding of the lake basins by snow melt. The older deposits are less suitable as construction sites due to increasing amount of excess ice with age.	Differential settlement may occur upon thaw of permafrost. Very poor drainage except where deeply incised. Pingos common where thaw-lake deposits developed in eolian sand.
Qal Alluvium	Stratified deposits of fine to medium sand, silty sand, gravel, and gravelly sand. Coarse sand and gravel occur along streams west of the Colville River, except in the Qe map unit. Gravel and gravelly sand common along streams in areas of bedrock, and along the Colville River and streams to the east. Contains detrital wood and peat. Includes deposits of flood-plain lakes and thaw lakes. Organic-rich silt occurs as thin overbank deposits and as thicker lacustrine deposits that fill abandoned channels. Small eolian dunes are common on modern point bars.	Occurs along all the major streams in the quadrangle, but is most extensive along the Colville, Chandler, Anaktuvuk, and Itkillik Rivers, which head in the Brooks Range. Includes flood-plain and alluvial terrace deposits as much as 8 m above modern streams. Probably not more than 5 m thick along modern channels, except along the Colville, Chandler, Anaktuvuk, and Itkillik Rivers where the deposits may be as thick as 20 m.	Forms channels and bars of the modern rivers and terraces of older river courses. Meander scrolls are well preserved on the lower terraces. Terrace drainage generally poor. Subject to flooding to 6 or 8 m above low water some streams.	Permafrost underlies the entire unit except for a 2 to 6 m thick unfrozen layer beneath some of the larger channels and lakes, and a thicker (perhaps perforating) unfrozen zone beneath the Colville River. Elsewhere, active layer about 0.5 m thick. Ice wedges are well developed in the terrace materials, and the silty deposits that form the filling material of abandoned channels contain abundant intergranular ice.	Organic-rich silty materials that fill abandoned channels and form overbank deposits are highly frost susceptible. Point bar and channel deposits with less than 6 percent silt are generally not frost susceptible.	Provides good foundations in channel and bar areas where material consists of medium to coarse sand, gravelly sand, and gravel; and moderately good to poor foundations on terraces and the older parts of flood-plains. Organic-rich lacustrine silt that fills abandoned channels is not suitable for foundations. Deposits with low silt content may be suitable for fill.	Subject to bank erosion, scour, channel shifting, and seasonal flooding. Wind erosion and dune building common on point bars and would occur on other parts of the flood plain and on terraces if surface vegetation is disturbed. Excavation of stream-bed materials may pose environmental problems.
Qat Alluvial terrace deposits	Fluvial deposits of interbedded silty sand, gravelly sand, and pebble to cobble gravel. Clast rock types include chert, sandstone, and chert-pebble conglomerate. Detrital wood and chunks of peat locally common. Overlain by thin eolian sand and peat. Penetrated and deformed by sand wedges.	Occurs on both sides of the Colville and Itkillik Rivers in northern map area. Thickness undetermined but in excess of 10 m. Overlying eolian sand and peat from 0.5 to 2 m thick.	Forms residual surfaces between thaw lake basins. Surfaces are fluvial terrace remnants that occur from 6 to 10 m above modern flood plains. Drainage generally good.	Permafrost present beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m.	Silty sand marginally frost susceptible depending on silt content.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand, and locally gravel, may be suitable for fill, base course, or surfacing.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Susceptible to wind erosion if surface vegetation is removed. Sand-wedge materials may be liquefiable when thawed and saturated.
Qe Eolian sand	Fine to very fine sand containing abundant quartz with minor dark minerals. Well sorted. Stratified, with large-scale cross bedding in places. Contains peat beds and wood in upper few m.	Occupies most of the northwestern part of the quadrangle. Thickness ranges from 0.5 m to more than 30 m. This unit forms the eastern edge of a large sand sea (Carter, 1981).	Forms generally well drained linear dune ridges as much as 30 m high upon which are superimposed parabolic dunes that are generally less than 1 m high. Contains poorly drained depressions that are not part of an integrated drainage system.	Permafrost underlies entire unit. Active layer less than 1.5 m thick on well drained slopes and summits and less than 0.5 m thick in poorly drained depressions. Ice wedges occur in the upper few m but the remainder of the deposits is generally free of excess ice in excess of natural voids. However, the presence of deep lakes (Sloan and Snyder, 1978) may indicate that the eolian sand overlies sediments that contain large amounts of massive ice.	Generally not frost susceptible, except where silt content exceeds 6 percent.	Adequate for natural foundations but requires stabilization for use as a surfacing material or fill. Relatively easy to excavate with a ripper on well drained dune ridges.	Extremely susceptible to wind erosion when protective vegetation is removed. Very sensitive to surface disturbances. Active blowouts present in places. Locally, sand may be liquefiable when thawed and saturated.
Qam Alluvial sand over marine silt and clay	Predominantly fluvial silty sand with scattered granules and pebbles, but includes minor sandy pebble gravel. Pebbles composed primarily of chert and quartz. Overlies marine silt and clay which is exposed at altitudes that range from 8 to 20 m. Overlying the fluvial sand is thin eolian sand and peat; sand wedges of fine to very fine eolian sand penetrate and deform the alluvial sand.	Occurs on both sides of Judy Creek in the northwest part of the quadrangle. Fluvial sand 3 to 6 m thick, marine silt and clay of unknown thickness. Eolian sand and peat 1 to 2 m thick.	Forms residual surfaces between thaw lake basins. Drainage generally good. Not subject to snowmelt flooding.	Permafrost present beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m, and interstitial ice in excess of natural voids probably is present in the marine silt and clay.	Silty sand generally frost susceptible. Silt and clay highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base course, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Susceptible to wind erosion if surface vegetation is removed. Materials forming the sand wedges may be liquefiable when thawed and saturated.
QTas Alluvial and eolian sand and marine sand and silt	Highly variable composition, but generally consists of stratified deposits of marine silty sand, gravelly sand, silt, and minor clay, overlain by fluvial silty sand, gravelly sand, and minor organic-rich silt, which in turn locally is overlain by eolian sand. In places, marine deposits do not occur, and only fluvial and eolian deposits are present. The base of the marine deposits is exposed only in bluffs along the right bank of the Colville River, where it is marked by a sparse lag of pebbles, cobbles, and boulders. Rock types in the lag include those characteristic of map units Tsg and Tg. The marine deposits commonly are fossiliferous, containing mollusks, foraminifers, ostracodes, and rare marine mammal remains. The deposits of two marine transgressions occur and locally may be superposed. Fluvial deposits locally contain buried peat beds, and logs of spruce, larch, and poplar. The lower part of the eolian sand contains ventifacted pebbles of chert and quartz derived from the fluvial deposits. Wedges of pebble-free eolian sand penetrate and deform the underlying deposits. Peat and/or peaty, silty sand occurs at the top of the unit.	Occurs on both sides of the Colville River in the northern part of the quadrangle. Thickness of marine deposits 1 to 6 m; fluvial deposits 10 to 20 m, eolian deposits 1 to 5 m; peat and peaty sand 1 to 2 m. Aggregate thickness 12 to 20 m.	Forms flat to gently rolling terrain broken by thaw-lake basins and ravines. Drainage good on slopes, fair to poor on flatter surfaces.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m. Silty, organic-rich silt, and clay may have interstitial ice in excess of natural voids.	Silty sand generally frost susceptible. Silt and clay highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base course, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Sand-wedge filling subject to liquefaction if thawed and saturated. Susceptible to wind erosion if surface vegetation is removed.
Qc Colluvial deposits	Silt and very fine sand with dispersed pebbles and cobbles. Contains disseminated, fine-grained organic matter and, in places, chunks of peat of various sizes, and pieces of detrital wood. Bones of extinct Pleistocene mammals locally present. Includes gravelly alluvium in valley bottoms.	Occurs throughout the quadrangle except for the northwest quarter. Thickness from 1 to 10 m.	Forms valley and gully slopes and bottoms. Drainage good on upper slopes, poor on lower slopes and in valley and gully bottoms.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Contains ice wedges and moderate to high volumes of interstitial ice beneath lower slopes and valley bottoms.	Highly frost susceptible.	Generally unsuitable as a source for materials because of organic content. Not suitable for foundations on lower slopes and valley bottoms because of excessive differential settlement on thaw of ice-rich permafrost.	Easily gullied by running water. Disruption of surface vegetation on lower slopes and valley bottoms may cause melting of ground ice and lead to subsidence.
Qaf Alluvial fan deposits	Stratified to poorly stratified silty, gravelly sand to silty, sandy gravel. Common organic debris.	Occurs east of the Itkillik River in the northern half of the quadrangle. Thickness undetermined but perhaps a few tens of m.	Forms flat to gently undulating surfaces. Drainage poor to fair.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Contains ice wedges and moderate to high volumes of interstitial ice.	Moderately to highly frost susceptible.	Generally unsuitable as a source for materials because of organic content. Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost.	-----
Qus Qus$_1$ Qus$_2$ Upland silt and sand	Predominantly wind blown very fine sand and silt. Includes some clay and layers and lenses of chert granules and pebbles. Stratification indistinct. Gravelly sand to sandy gravel locally composes lower part of deposit. Clasts predominatly pebble-sized, well rounded, and composed of chert and quartz. Very poorly exposed. The designation Qus$_2$ indicates that the deposit overlies a sheet of pebble, cobble, and boulder gravel 10 to 20 m thick that forms an extensive terrace of the Colville River. East of the Itkillik River, the northern part of this unit defines a former course of the Colville River that was abandoned as a result of stream piracy. The designation Qus$_1$ indicates that upland silt and sand overlies discontinuous deposits of pebble, cobble, and boulder gravel as much as 10 m thick in the southwestern part of the quadrangle that are the eroded remnants of ancient fluvial or glaciefluvial terraces which are much older than the gravel of Qus$_2$.	Occurs throughout much of the quadrangle except for the northwest and northcentral parts. Ranges from a few m to as much as 20 thick.	Forms flat to gently rolling terrain broken by deep thaw-lake basins, major stream valleys, and ravines. Drainage good on slopes, fair to poor on flatter surfaces.	Active layer generally less than 0.5 m thick. Ice wedges well developed and sediment may contain a high volume of interstitial ice.	Silt and silty sand are frost susceptible.	Not suitable for borrow except as binder material. Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost.	Easily gullied by running water when water is channeled by construction activities or when surface vegetation may cause melting of ice wedges and lead to subsidence. Locally deposits may be liquefiable when thawed and saturated.
Qm Younger morainal deposits	Deposits not exposed, but probably consist of unsorted, generally nonstratified compact till. Composition may range from muddy, sandy, bouldery gravel to a sandy, bouldery silt. Stratified ice-contact deposits composed of moderately sorted sand and sandy gravel locally may be present. Overlain by a continuous cover of organic silt from 1 to several m thick.	Occurs on both sides of the Itkillik River in the southeast corner of the quadrangle. Thickness variable but at least 75 m beneath the crest of the moraine.	Forms a broad moraine with irregular topography. Slopes well drained, depressions poorly drained.	Permafrost present beneath an active layer 0.5 to 1 m thick. Probably ice-rich in the upper few m, especially in depressions.	Till moderately to highly frost susceptible depending on silt content. Depression fillings probably highly frost-susceptible.	Depressions unsuitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Slopes on silt and clay-rich till unsuitable because they are generally unstable. Construction materials generally not available.	Slopes subject to mass movements, especially solifluction and earth flows.
Tm Morainal deposits and drift of intermediate age	Unsorted, unstratified compact till composed of sandy, bouldery silt and clayey silt. Very poorly exposed. Stratified ice-contact deposits composed of moderately sorted sand and sandy gravel locally may be present. Overlain by a continuous cover of organic silt from 1 to several m thick.	Occurs on both sides of the Itkillik River in the southeast corner of the quadrangle. Thickness unknown but possibly as much as 100 m beneath the crest of the moraine.	Forms a morainal ridge west of the Itkillik River and flanks drift east of the river. Drainage generally good.	Permafrost present beneath an active layer 0.5 to 1 m thick. Probably ice-rich in the upper few m.	Highly frost susceptible	Construction materials not generally available. Not suitable for foundations because of cover of organic silt and unstable slopes.	Slopes subject to mass movements, especially solifluction and earth flows.
Td Older drift	Materials not exposed but existence of glacial drift inferred from the arcuate pattern of the hilly terrain of this map unit west of the Itkillik River, the presence of erratics as lag accumulations in stream beds there, and the occurrence of erratics on ridge crests east of the Itkillik River. Erratics may indicate the presence of till or may have been incorporated in younger fluvial gravel. Continuous cover of organic silt several m thick.	Occurs on both sides of the Itkillik River in the southeast corner of the quadrangle. Thickness unknown but possible as thick as 30 m west of the Itkillik River.	Forms hilly terrain with gentle slopes that define an arcuate pattern west of the Itkillik River. Occurs on ridge crests east of the Itkillik River. Drainage generally good.	Permafrost present beneath an active layer 0.5 to 1 m thick. Organic silt cover is ice-rich.	Organic silt cover highly frost susceptible.	Unsuitable for foundations due to cover of ice-rich organic silt. Construction materials not generally available.	-----
Tgs Gravelly sand	Gravelly sand to sandy gravel. Clasts predominantly pebble-sized, well rounded, and composed of chert and quartz. Very poorly exposed.	Occurs on the east side of the Colville River - Itkillik River valley in the northwestern part of the quadrangle, where it underlies QTas. Thickness about 1 to 3 m.	Forms an indistinct bench on the valley side. Well drained.	Perennially frozen beneath an active layer that is probably less than 1 m thick. Ice content unknown but probably not in excess of natural voids.	Probably not frost susceptible.	Not suitable for borrow due to thickness of overburden (QTas).	-----
Tat Alluvial terrace deposits	Fluvial deposits of pebble, cobble, and boulder gravel overlain by eolian and colluvial silt. Clast rock types include chert, sandstone, and chert-pebble conglomerate.	Occurs on west side of Tuluga River in southern part of quadrangle.	Forms benches on valley side and caps the drainage divide.	Permafrost present beneath an active layer that is generally less than 0.5 m thick.	Silt cover highly frost susceptible; fluvial gravel not frost susceptible.	Generally unsuitable as a source of materials because of silt overburden, small volume of gravel, and topographic position.	-----
Tsg	Nonmarine, moderately to poorly consolidated deposits of variable composition, ranging from	Exposed in river cut-banks in T7N, R8E in the northeastern part of the quadrangle. Exposed	Forms the lower parts of river cut-banks. Drainage generally good.	Perennially frozen. Generally low ice content but fine-grained units may contain ice in excess	Fine-grained beds susceptible to frost action.	Not suitable for borrow due to thickness of overburden and extensive weathering of some	-----

F1

	eolian sand and peat. Penetrates and deforms by sand wedges.						
Qe Eolian sand	Fine to very fine sand containing abundant quartz with minor dark minerals. Well sorted. Stratified, with large-scale cross bedding in places. Contains peat beds and wood in upper few m.	Occupies most of the northwestern part of the quadrangle. Thickness ranges from a few m to more than 30 m. This unit forms the eastern edge of a large sand sea (Carter, 1981).	Forms generally well drained linear dune ridges as much as 30 m high upon which are superimposed parabolic dunes that are generally less than 1 m high. Contains poorly drained depressions that are not part of an intergrated drainage system.	Permafrost underlies entire unit. Active layer less than 1.5 m thick on well drained slopes and summits and less than 0.5 m thick in poorly drained depressions. Ice wedges occur in the upper few m but the remainder of the deposits is generally free of excess ice in excess of natural voids. However, the presence of deep lakes (Sloan and Snyder, 1978) may indicate that the eolian sand overlies sediments that contain large amounts of massive ice.	Generally not frost susceptible, except where silt content exceeds 6 percent.	Adequate for natural foundations but requires stabilization for use as a surfacing material or fill. Relatively easy to excavate with a ripper on well drained dune ridges.	Extremely susceptible to wind erosion when protective vegetation is removed. Very sensitive to surface disturbances. Active blowouts present in places. Locally, sand may be liquefiable when thawed and saturated.
Qam Alluvial sand over marine silt and clay	Predominantly fluvial silty sand with scattered granules and pebbles, but includes minor sandy pebble gravel. Pebbles composed primarily of chert and quartz. Overlies marine silt and clay which is exposed at altitudes that range from 8 to 20 m. Overlying the fluvial sand is thin eolian sand and peat; sand wedges of fine to very fine eolian sand penetrate and deform the alluvial sand.	Occurs on both sides of Judy Creek in the northwest part of the quadrangle. Fluvial sand 3 to 6 m thick, marine silt and clay of unknown thickness. Eolian sand and peat 1 to 2 m thick.	Forms residual surfaces between thaw lake basins. Drainage generally good. Not subject to snowmelt flooding.	Permafrost present beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m, and interstitial ice in excess of natural voids probably is present in the marine silt and clay.	Silty sand generally frost susceptible. Silt and clay highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base course, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Susceptible to wind erosion if surface vegetation is removed. Materials forming the sand wedges may be liquefiable when thawed and saturated.
QTas Alluvial and eolian sand and marine sand and silt	Highly variable composition, but generally consists of stratified deposits of marine silty sand, gravelly sand, silt, and minor clay, overlain by fluvial silty sand, gravelly sand, and minor organic-rich silt, which in turn locally is overlain by eolian sand. In places, marine deposits do not occur, and only fluvial and eolian deposits are present. The base of the marine deposits is exposed only in bluffs along the right bank of the Colville River, where it is marked by a sparse lag of pebbles, cobbles, and boulders. Rock types in the lag include those characteristic of map units Tsg and Tg. The marine deposits commonly are fossiliferous, containing mollusks, foraminifers, ostracodes, and rare marine mammal remains. The deposits of two marine transgressions occur and locally may be superposed. Fluvial deposits locally contain buried peat beds, and logs of spruce, larch, and poplar. The lower part of the eolian sand contains ventifacted pebbles of chert and quartz derived from the fluvial deposits. Wedges of pebble-free eolian sand penetrate and deform the underlying deposits. Peat and/or peaty, silty sand occurs at the top of the unit.	Occurs on both sides of the Colville River in the northern part of the quadrangle. Thickness of marine deposits 1 to 6 m, fluvial deposits 10 to 20 m; eolian deposits 1 to 5 m; peat and peaty sand 1 to 2 m. Aggregate thickness 12 to 20 m.	Forms flat to gently rolling terrain broken by thaw-lake basins and ravines. Drainage good on slopes, fair to poor on flatter surfaces.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m. Silt, organic-rich silt, and clay may have interstitial ice in excess of natural voids.	Silty sand generally frost susceptible. Silt and clay highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base course, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Sand-wedge filling subject to liquefaction if thawed and saturated. Susceptible to wind erosion if surface vegetation is removed.
Qc Colluvial deposits	Silt and very fine sand with dispersed pebbles and cobbles. Contains disseminated, fine-grained organic matter and, in places, chunks of peat of various sizes, and pieces of detrital wood. Bones of extinct Pleistocene mammals locally present. Includes gravelly alluvium in valley bottoms.	Occurs throughout the quadrangle except for the northwest quarter. Thickness from 1 to 10 m.	Forms valley and gully slopes and bottoms. Drainage good on upper slopes, poor on lower slopes and in valley and gully bottoms.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Contains ice wedges and moderate to high volumes of interstitial ice beneath lower slopes and valley bottoms.	Highly frost susceptible.	Generally unsuitable as a source for materials because of organic content. Not suitable for foundations on lower slopes and valley bottoms because of excessive differential settlement on thaw of ice-rich permafrost.	Easily gullied by running water. Disruption of surface vegetation on lower slopes and valley bottoms may cause melting of ground ice and lead to subsidence.
Qaf Alluvial fan deposits	Stratified to poorly stratified silty, gravelly sand to silty, sandy gravel. Common organic debris.	Occurs east of the Itkillik River in the northern half of the quadrangle. Thickness undetermined but perhaps a few tens of m.	Forms flat to gently undulating surfaces. Drainage poor to fair.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Contains ice wedges and moderate to high volumes of interstitial ice.	Moderately to highly frost susceptible.	Generally unsuitable as a source for materials because of organic content. Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost.	-----
Qus Qus_1 Qus_2 Upland silt and sand	Predominantly wind blown very fine sand and silt. Includes some clay and layers and lenses of chert granules and pebbles. Stratification indistinct. Gravelly sand to sandy gravel locally composes lower part of deposit. Clasts predominatly pebble-sized, well rounded, and composed of chert and quartz. Very poorly exposed. The designation Qus_2 indicates that the deposit overlies a sheet of pebble, cobble, and boulder gravel 10 to 20 m thick that forms an extensive terrace of the Colville River. East of the Itkillik River, the northern part of this unit defines a former course of the Colville River that was abandoned as a result of stream piracy. The designation Qus_1 indicates that upland silt and sand overlies discontinuous deposits of pebble, cobble, and boulder gravel as much as 10 m thick in the southwestern part of the quadrangle that are the eroded remnants of ancient fluvial or glaciofluvial terraces which are much older than the gravel of Qus_2.	Occurs throughout much of the quadrangle except for the northwest and northcentral parts. Ranges from a few m to as much as 20 thick.	Forms flat to gently rolling terrain broken by deep thaw-lake basins, major stream valleys, and ravines. Drainage good on slopes, fair to poor on flatter surfaces.	Active layer generally less than 0.5 m thick. Ice wedges well developed and sediment may contain a high volume of interstitial ice.	Silt and silty sand are frost susceptible.	Not suitable for borrow except as binder material. Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost.	Easily gullied by running water when water is channeled by construction activities or when surface vegetation is removed. Disruption of surface vegetation may cause melting of ice wedges and lead to subsidence. Locally deposits may be liquefiable when thawed and saturated.
Qm Younger morainal deposits	Deposits not exposed, but probably consist of unsorted, generally nonstratified compact till. Composition may range from muddy, sandy, bouldery gravel to a sandy, bouldery silt. Stratified ice-contact deposits composed of moderately sorted sand and sandy gravel locally may be present. Overlain by a continuous cover of organic silt from 1 to several m thick.	Occurs on both sides of the Itkillik River in the southeast corner of the quadrangle. Thickness variable but at least 75 m beneath the crest of the moraine.	Forms a broad moraine with irregular topography. Slopes well drained, depressions poorly drained.	Permafrost present beneath an active layer 0.5 to 1 m thick. Probably ice-rich in the upper few m, especially in depressions.	Till moderately to highly frost susceptible depending on silt content. Depression fillings probably highly frost-susceptible.	Depressions unsuitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Slopes on silt and clay-rich till unsuitable because they are generally unstable. Construction materials generally not available.	Slopes subject to mass movements, especially solifluction and earth flows.
Tm Morainal deposits and drift of intermediate age	Unsorted, unstratified compact till composed of sandy, bouldery silt and clayey silt. Very poorly exposed. Stratified ice-contact deposits composed of moderately sorted sand and sandy gravel locally may be present. Overlain by a continuous cover of organic silt from 1 to several m thick.	Occurs on both sides of the Itkillik River in the southeast corner of the quadrangle. Thickness unknown but possibly as much as 100 m beneath the crest of the moraine.	Forms a morainal ridge west of the Itkillik River and formless drift east of the river. Drainage generally good.	Permafrost present beneath an active layer 0.5 to 1 m thick. Probably ice-rich in the upper few m.	Highly frost suscept.ble	Construction materials not generally available. Not suitable for foundations because of cover of organic silt and unstable slopes.	Slopes subject to mass movements, especially solifluction and earth flows.
Td Older drift	Materials not exposed but existence of glacial drift inferred from the arcuate pattern of the hilly terrain of this map unit west of the Itkillik River, the presence of erratics as lag accumulations in stream beds there, and the occurrence of erratics on ridge crests east of the Itkillik River. Erratics may indicate the presence of till or may have been incorporated in younger fluvial gravel. Continuous cover of organic silt several m thick.	Occurs on both sides of the Itkillik River in the southeast corner of the quadrangle. Forms hilly terrain with gentle slopes that define an arcuate pattern west of the Itkillik River. Occurs on ridge crests east of the Itkillik River. Drainage generally good.	Permafrost present beneath an active layer 0.5 to 1 m thick. Organic silt cover is ice-rich.	Organic silt cover highly frost susceptible.	Unsuitable for foundations due to cover of ice-rich organic silt. Construction materials not generally available.	-----
Tgs Gravelly sand	Gravelly sand to sandy gravel. Clasts predominantly pebble-sized, well rounded, and composed of chert and quartz. Very poorly exposed.	Occurs on the east side of the Colville River - Itkillik River valley in the northeastern part of the quadrangle, where it underlies QTas. Thickness about 1 to 3 m.	Forms an indistinct bench on the valley side. Well drained.	Perennially frozen beneath an active layer that is probably less than 1 m thick. Ice content unknown but probably not in excess of natural voids.	Probably not frost susceptible.	Not suitable for borrow due to thickness of overburden (QTas).	-----
Tat Alluvial terrace deposits	Fluvial deposits of pebble, cobble, and boulder gravel overlain by eolian and colluvial silt. Clast rock types include chert, sandstone, and chert-pebble conglomerate.	Occurs on west side of Tuluga River in southern part of quadrangle.	Forms benches on valley side and caps the drainage divide.	Permafrost present beneath an active layer that is generally less than 0.5 m thick.	Silt cover highly frost susceptible; fluvial gravel not frost susceptible.	Generally unsuitable as a source of materials because of silt overburden, small volume of gravel, and topographic position.	-----
Tsg Sand, gravelly sand, conglomerate, and pebbly mud	Nonmarine, moderately to poorly consolidated deposits of variable composition, ranging from conglomerate to sandy gravel, gravelly sand, sand, and pebbly mud. Locally contains lignitized logs of large coniferous trees. Contains disseminated sulfur in places.	Exposed in river cut-banks in T7N, R8E in the northeastern part of the quadrangle. Exposed thickness (incomplete) ranges from 2 to 8 m; total thickness considerably greater but unknown. Overlain by 3 to 10 m of younger deposits.	Forms the lower parts of river cut-banks. Drainage generally good.	Perennially frozen. Generally low ice content but fine-grained units may contain ice in excess of natural voids.	Fine-grained beds susceptible to frost action.	Not suitable for borrow due to thickness of overburden and extensive weathering of some clasts.	-----
TKg Conglomerate	Pebble, cobble, and boulder conglomerate. Clasts predominantly of hard, resistant rock types common in nearby parts of the Brooks Range, including chert, quartz, sandstone, and chert-pebble conglomerate. Erratics to 1.5 m in diameter locally common. Poorly exposed; parts of deposit may have silty matrix and may be till. In the southern part of the area locally contains clasts composed of metamorphic, intrusive, and volcanic rock types which do not occur in nearby parts of the Brooks Range and which are distinct from the rock types found in younger glaciomarine deposits.	Occurs east of the Itkillik River in the northeast part of the quadrangle as interbeds in TKcs and as a sheet that underlies Qus in this area. Up to 40 m thick.	Forms bluffs on the upper and middle slopes of valleys. Well drained.	Entire unit is perennially frozen. Thickness of active layer is unknown but may be as much as 2 m on unvegetated, south-facing slopes. Ice content not known but probably not in excess of natural voids.	Susceptible to frost action where matrix is silty.	Suitable for fill, base course, and surface course (with proper grading), but unsatisfactory for aggregate because of chert content. Provides good foundations near bluff tops where silt cover is not excessive.	-----
TKcs Kc ks of the Sagavanirktok Formation undifferentiated (TKcs) and the Colville group (Kc)	Nonmarine and marine sandstone, siltstone, and shale with coaly beds and thin tephra layers; thinly to thickly bedded; moderately to poorly indurated. Fine-grained beds are commonly bentonitic.	Underlies over much of the quadrangle exept for the northwest, northcentral, and eastcentral parts.	Forms rolling uplands and steep river bluff. Well drained.	Perennially frozen but ice content insignificant except in thoroughly weathered surficial zones and in the upper few m of shale on low gradient upland surfaces where ice wedges may be present.	Thin bedded and/or fine-grained units susceptible to frost action.	Locally suitable for borrow when not bentonitic.	Subject to debris flows, rock falls, and landslides (shown by hachures on map in extreme western part of map). Slopes may be inherently unstable where bentonitic beds are present.
Kn Rocks of Nanushuk group	Nonmarine and marine sandstone, siltstone, shale and conglomerate. Thinly to thickly bedded; well to poorly indurated.	Occurs in an east-west trending belt across the southwest part of the quadrangle.	Forms east-west trending hills and valleys and steep river bluffs.	Perennially frozen but ice content generally insignificant except in thorough weathered surficial zones.	Thin bedded and/or fine-grained units susceptible to frost action.	Locally suitable for borrow. Normally makes good foundations.	Subject to rock falls on steep slopes.

ENGINEERING-GEOLOGIC MAPS OF NORTHERN ALASKA, UMIAT QUADRANGLE

by

L. David Carter and John P. Galloway

1986

F2

This report is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.